Claims

We claim:

1. A system for generating a sign pattern for a digital impairment learning (DIL) signal, comprising:

means for selecting a sign pattern length comprising a positive integer that is wholly divisible by four and is not wholly divisible by three, the sign pattern comprising an even subsequence and an odd subsequence, each subsequence comprising zeros and ones corresponding to negative and positive signs, respectively;

means for balancing a number of zeros in the even subsequence with a number of ones in the even subsequence; and

means for balancing a number of zeros in the odd subsequence with a number of ones in the odd subsequence.

2. A system as recited in Claim 1, wherein the DIL signal comprises at least one DIL segment having a DIL segment length and wherein the means for selecting the sign pattern length comprises:

means for selecting a sign pattern length comprising a positive integer that is wholly divisible by four, that is not wholly divisible by three, and that wholly divides the DIL segment length.

3. A system as recited in Claim 2, wherein the DIL segment length divided by six is a power of two.

4. A system for generating a digital impairment learning (DIL) signal, comprising:

means for organizing a plurality of symbols into a plurality of mutually exclusive symbol groups, each of the plurality of symbol groups being associated with a contiguous subset of the plurality of symbols; and

means for generating a sequence of symbols selected from the plurality of symbols such that adjacent symbols in the sequence are associated with different

symbol groups of the plurality of symbol groups and the different symbol groups are separated by at most a maximum group spacing difference.

5. A system as recited in Claim 4, wherein the maximum group spacing difference is two.

6. A system as recited in Claim 4, wherein the means for generating the sequence comprises:

means for defining a symbol group sequence;

means for defining a symbol offset sequence that specifies sub-sequences within the sequence of symbols, each sub-sequence corresponding to symbols comprising one of the plurality of symbol groups; and

means for selecting each symbol in the sequence from the plurality of symbols in accordance with the symbol group sequence and from within each of the plurality of symbol groups in accordance with the symbol offset sequence.

7. A system as recited in Claim 6, wherein the symbol offset sequence is a pseudo-random sequence.

8. A system as recited in Claim 4, wherein the means for generating the sequence of symbols selected from the plurality of symbols comprises:

means for generating a sequence of symbols selected from a contiguous portion of the plurality of symbols such that adjacent symbols are associated with different symbol groups of the plurality of symbol groups and the different symbol groups are separated by at most two of the plurality of symbol groups.

9. A system for generating a digital impairment learning (DIL) signal, comprising:

means for organizing a plurality of ucodes into a plurality of uchords;

means for defining a uchord sequence;

means for defining a ucode offset sequence; and

means for generating a sequence of ucodes, each ucode in the sequence being selected from the plurality of ucodes in accordance with the uchord sequence and

from within each of the plurality of uchords in accordance with the ucode offset sequence.

10. A system as recited in Claim 9, wherein the plurality of ucodes comprises 128 ucodes, the plurality of uchords comprises 8 uchords, each of the uchords being associated with 16 contiguous ucodes, and the uchord sequence is defined as 0, 2, 4, 6, 7, 5, 3, 1.

11. A system as recited in Claim 9, wherein the plurality of ucodes comprises 128 ucodes, the plurality of uchords comprises 8 uchords, each of the uchords being associated with 16 contiguous ucodes, and the ucode offset sequence is defined as 1, 4, 7, 10, 13, 0, 3, 6, 9, 12, 15, 2, 5, 8, 11, 14.

12. A method of generating a sign pattern for a digital impairment learning (DIL) signal, comprising the steps of:

selecting a sign pattern length comprising a positive integer that is wholly divisible by four and is not wholly divisible by three, the sign pattern comprising an even subsequence and an odd subsequence, each subsequence comprising zeros and ones corresponding to negative and positive signs, respectively;

balancing a number of zeros in the even subsequence with a number of ones in the even subsequence; and

balancing a number of zeros in the odd subsequence with a number of ones in the odd subsequence.

13. A method as recited in Claim 12, wherein the DIL signal comprises at least one DIL segment having a DIL segment length and wherein the step of selecting the sign pattern length comprises the step of:

selecting a sign pattern length comprising a positive integer that is wholly divisible by four, that is not wholly divisible by three, and that wholly divides the DIL segment length.

14. A method as recited in Claim 13, wherein the DIL segment length divided by six is a power of two.

15. A method of generating a digital impairment learning (DIL) signal, comprising the steps of:

organizing a plurality of symbols into a plurality of mutually exclusive symbol groups, each of the plurality of symbol groups being associated with a contiguous subset of the plurality of symbols; and

generating a sequence of symbols selected from the plurality of symbols such that adjacent symbols in the sequence are associated with different symbol groups of the plurality of symbol groups and the different symbol groups are separated by at most a maximum group spacing difference.

16. A method as recited in Claim 15, wherein the maximum group spacing difference is two.

17. A method as recited in Claim 15, wherein the step of generating the sequence comprises the steps of:

defining a symbol group sequence;

defining a symbol offset sequence that specifies sub-sequences within the sequence of symbols, each sub-sequence corresponding to symbols comprising one of the plurality of symbol groups; and

selecting each symbol in the sequence from the plurality of symbols in accordance with the symbol group sequence and from within each of the plurality of symbol groups in accordance with the symbol offset sequence.

18. A method as recited in Claim 17, wherein the symbol offset sequence is a pseudo-random sequence.

19. A method as recited in Claim 15, wherein the step of generating the sequence of symbols selected from the plurality of symbols comprises the step of:

generating a sequence of symbols selected from a contiguous portion of the plurality of symbols such that adjacent symbols are associated with different symbol groups of the plurality of symbol groups and the different symbol groups are separated by at most two of the plurality of symbol groups.

20. A method of generating a digital impairment learning (DIL) signal, comprising the steps of:

organizing a plurality of ucodes into a plurality of uchords;

defining a uchord sequence;

defining a ucode offset sequence; and

generating a sequence of ucodes, each ucode in the sequence being selected from the plurality of ucodes in accordance with the uchord sequence and from within each of the plurality of uchords in accordance with the ucode offset sequence.

21. A method as recited in Claim 20, wherein the plurality of ucodes comprises 128 ucodes, the plurality of uchords comprises 8 uchords, each of the uchords being associated with 16 contiguous ucodes, and the uchord sequence is defined as 0, 2, 4, 6, 7, 5, 3, 1.

22. A method as recited in Claim 20, wherein the plurality of ucodes comprises 128 ucodes, the plurality of uchords comprises 8 uchords, each of the uchords being associated with 16 contiguous ucodes, and the ucode offset sequence is defined as 1, 4, 7, 10, 13, 0, 3, 6, 9, 12, 15, 2, 5, 8, 11, 14.

23. A computer program product for generating a sign pattern for a digital impairment learning (DIL) signal, comprising:

a computer readable storage medium having computer readable program code embodied therein, the computer readable program code comprising:

computer readable program code for selecting a sign pattern length comprising a positive integer that is wholly divisible by four and is not wholly divisible by three, the sign pattern comprising an even subsequence and an odd subsequence, each subsequence comprising zeros and ones corresponding to negative and positive signs, respectively;

computer readable program code for balancing a number of zeros in the even subsequence with a number of ones in the even subsequence; and

computer readable program code for balancing a number of zeros in the odd subsequence with a number of ones in the odd subsequence.

24. A computer program product as recited in Claim 23, wherein the DIL signal comprises at least one DIL segment having a DIL segment length and wherein the computer readable program code for selecting the sign pattern length comprises:

computer readable program code for selecting a sign pattern length comprising a positive integer that is wholly divisible by four, that is not wholly divisible by three, and that wholly divides the DIL segment length.

25. A computer program product as recited in Claim 24, wherein the DIL segment length divided by six is a power of two.

26. A computer program product for generating a digital impairment learning (DIL) signal, comprising:

a computer readable storage medium having computer readable program code embodied therein, the computer readable program code comprising:

computer readable program code for organizing a plurality of symbols into a plurality of mutually exclusive symbol groups, each of the plurality of symbol groups being associated with a contiguous subset of the plurality of symbols; and

computer readable program code for generating a sequence of symbols selected from the plurality of symbols such that adjacent symbols in the sequence are associated with different symbol groups of the plurality of symbol groups and the different symbol groups are separated by at most a maximum group spacing difference.

27. A computer program product as recited in Claim 26, wherein the maximum group spacing difference is two.

28. A computer program product as recited in Claim 26, wherein the computer readable program code for generating the sequence comprises:

computer readable program code for defining a symbol group sequence;

computer readable program code for defining a symbol offset sequence that specifies sub-sequences within the sequence of symbols, each sub-sequence corresponding to symbols comprising one of the plurality of symbol groups; and

computer readable program code for selecting each symbol in the sequence from the plurality of symbols in accordance with the symbol group sequence and from within each of the plurality of symbol groups in accordance with the symbol offset sequence.

29. A computer program product as recited in Claim 28, wherein the symbol offset sequence is a pseudo-random sequence.

30. A computer program product as recited in Claim 26, wherein the computer readable program code for generating the sequence of symbols selected from the plurality of symbols comprises:

computer readable program code for generating a sequence of symbols selected from a contiguous portion of the plurality of symbols such that adjacent symbols are associated with different symbol groups of the plurality of symbol groups and the different symbol groups are separated by at most two of the plurality of symbol groups.

31. A computer program product for generating a digital impairment learning (DIL) signal, comprising:

a computer readable storage medium having computer readable program code embodied therein, the computer readable program code comprising:

computer readable program code for organizing a plurality of ucodes into a plurality of uchords;

computer readable program code for defining a uchord sequence;

computer readable program code for defining a ucode offset sequence; and

computer readable program code for generating a sequence of ucodes, each ucode in the sequence being selected from the plurality of ucodes in accordance with the uchord sequence and from within each of the plurality of uchords in accordance with the ucode offset sequence.

32. A computer program product as recited in Claim 31, wherein the plurality of ucodes comprises 128 ucodes, the plurality of uchords comprises 8

uchords, each of the uchords being associated with 16 contiguous ucodes, and the uchord sequence is defined as 0, 2, 4, 6, 7, 5, 3, 1.

33. A computer program product as recited in Claim 31, wherein the plurality of ucodes comprises 128 ucodes, the plurality of uchords comprises 8 uchords, each of the uchords being associated with 16 contiguous ucodes, and the ucode offset sequence is defined as 1, 4, 7, 10, 13, 0, 3, 6, 9, 12, 15, 2, 5, 8, 11, 14.

34. A digital impairment learning (DIL) signal, comprising:

a sequence of symbols; and

the sequence of symbols having a sign pattern length comprising a positive integer that is wholly divisible by four and is not wholly divisible by three, the sign pattern comprising an even subsequence and an odd subsequence, each subsequence comprising zeros and ones such that a number of zeros and a number of ones are equal in both subsequences, the zeros and ones corresponding to negative and positive signs, respectively. .

35. A DIL signal as recited in Claim 34, wherein the DIL signal comprises at least one DIL segment having a DIL segment length and wherein the sign pattern length comprises a positive integer that is wholly divisible by four, that is not wholly divisible by three, and that wholly divides the DIL segment length.

36. A DIL signal as recited in Claim 35, wherein the DIL segment length divided by six is a power of two.

37. A digital impairment learning (DIL) signal, comprising:

a sequence of symbols selected from a plurality of symbols, the plurality of symbols being organized into a plurality of mutually exclusive symbol groups, each of the plurality of symbol groups being associated with a contiguous subset of the plurality of symbols, such that adjacent symbols in the sequence are associated with different symbol groups of the plurality of symbol groups and the different symbol groups are separated by at most a maximum group spacing difference.

38. A method as recited in Claim 37, wherein the maximum group spacing difference is two.

39. A digital impairment learning (DIL) signal, comprising:

a sequence of ucodes, the ucodes being organized into a plurality of uchords, each ucode in the sequence being selected from a plurality of ucodes in accordance with a uchord sequence and from within each of the plurality of uchords in accordance with a ucode offset sequence.

40. A method as recited in Claim 39, wherein the plurality of ucodes comprises 128 ucodes, the plurality of uchords comprises 8 uchords, each of the uchords being associated with 16 contiguous ucodes, and the uchord sequence is defined as 0, 2, 4, 6, 7, 5, 3, 1.

41. A method as recited in Claim 39, wherein the plurality of ucodes comprises 128 ucodes, the plurality of uchords comprises 8 uchords, each of the uchords being associated with 16 contiguous ucodes, and the ucode offset sequence is defined as 1, 4, 7, 10, 13, 0, 3, 6, 9, 12, 15, 2, 5, 8, 11, 14.